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*Publication date:*  
1987

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*Citation for published version (APA):*

Ruys, P. H. M. (1987). *Industries with private and public enterprises*. (Research memorandum / Tilburg University, Department of Economics; Vol. FEW 290). Unknown Publisher.

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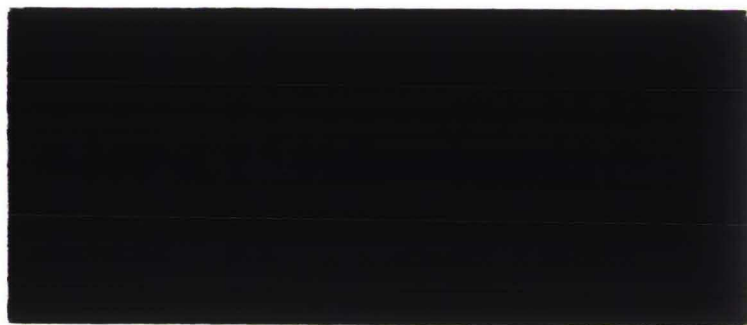
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RESEARCH MEMORANDUM



INDUSTRIES WITH PRIVATE AND PUBLIC  
ENTERPRISES

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FEW 290

September 1987

Accepted for publication in the European Economic  
Review, 1988.

# Industries with private and public enterprises

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## 1. Introduction

In this paper attention will be focussed on an industry with public enterprises and institutions, rather than on a public enterprise itself. Public enterprises can be used by the government as an instrument to implement an industrial policy. Since there exist a variety of instruments and objectives, we firstly categorize industries as well as market structures (section 2). Next, we mention some recent results (section 3). In the last section a general equilibrium model is introduced that offers a framework to policy makers when designing an efficient organization of an industry with external effects.

## 2. Regulation and organization of an industry

The performance criteria for individual (private or public) enterprises are derived in our approach from the government policy regarding the industry to which the enterprises belong. An industry is a set of enterprises supplying closely related markets, and of rules and institutions serving or coordinating these enterprises. All markets are considered in which commodities are traded that are close substitutes or complements. Industries are therefore serving multiproduct markets, such as transportation, health or agriculture. Some products may be weakly marketable, i.e., their average operating cost is not covered by the consumers' price, e.g. urban transport. Other products may be strongly marketable, e.g. private cars. The output of an industry, however, is always assumed to consists of marketable, private goods, possibly with external effects in production or consumption.

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\*) Comments by Dieter Böss, Rob Gilles, Gerard van der Laan and Dolf Talman are gratefully acknowledged. This research project is part of the VF program Equilibrium and Disequilibrium.



An industry is called regulated if the government wants to determine the supply and the consumers' prices on the important markets of the industry. An industry is called organized if there is an institution, possibly non-governmental, that is concerned with the optimal performance of the markets in the industry, and that also has the power to impose the necessary measures and conditions. This organization may actively be supported by the government, such as anti-cartel legislation. If there is no interference with markets or market performance in an industry, we call it a free industry.

There may be a great variety in institutional behavior and legal foundation of the enterprises within an industry. We will categorize them according to the degree of (economic) freedom an enterprise has in determining its own existential role in the industry: can it determine its own marketing decisions and goals? Since privately owned enterprises may be fully or partly regulated, and government owned enterprises may be profit maximizes, ownership is not a sufficient indication for behavior. Enterprises are called private if their marketing decisions and goals are free, and public if these are enforced by the government. Enterprises are called specialized if their marketing decisions and goals depend on statutory contracts, which can either be entered freely (private firms) or be enforced by a public body (public firms). For example, an autonomously profit-maximizing private clinic, or an autonomous non-profit hospital are both private enterprises. If they are, however, statutorily embedded in a nationalized health system, they are specialized enterprises.

The set of buyers and sellers, each characterized by their institutional behavior, market size, and number, is called the market structure of an industry. It is affected by the technology and the strategy of the enterprises, by external effects, and by the government policy. The supply side of the market structure ranges from only private firms, to only public firms. An intermediate market structure may refer to a mixed structure of private and public firms or to a privatized structure of partly privately owned enterprises. This categorization is summarized in diagram 1. According on the external effects or the monopoly profits are considered to be more important, the industry moves usually from the left to the

right in the diagram (regulation), or from above to below (nationalization).

Both the public sector and the regulation of the industry have been grown impressively in all European countries during the last decades. Still, there does not exist too much economic theory about public decision

Diagram 1: Industry structure and market structure

Market structure	Industry structure		
	Free	Organized	Regulated
Private firms	competitive oligopolistic monopolistic	anti-cartel	agriculture
Specialized Mixed or Privatized	licencing	see section 3	health; transportation; steel
Public firms	-	cooperative public utilities	public utilities; socialist countries

making and even the existing theory (Boiteux, Hotelling a.o.) has been applied to a very limited extent. To this conclusion arrive Deleau (1987) for France and Kay, Mayer and Thompson (1986) for the United Kingdom. It is being realized at this moment how extremely difficult it is to formulate and to implement the objective of "social welfare" which the public manager ought to maximize. But an unambiguous and controllable formulation could be even more dangerous for public enterprises, because it is the government who ultimately specifies it, and the (short term) interests of a government may very easily conflict with the (long term) interests of an industry.

The alleged inefficiency of public enterprises and regulated industries is now being cured with measures such as privatization and deregulation. It should be stressed that such measures only work if no serious market failures occur in the industry. Even if all enterprises in the industry produce efficiently, the industry as a whole may perform inefficiently or unsatisfactorily. Efficient bus companies, e.g., may not prevent congestion in urban areas. It seems worthwhile to look after other methods than privatization or deregulation in order to improve the efficiency of an industry.

### 3. Some industrial policy measures

The first objective of an industrial policy mentioned here is to reduce the social cost of monopoly power. If one wants to leave the industry free, one might (partially) nationalize the monopoly and distribute the profits (see Bös, 1987). Or, if one wants the enterprises private, one might regulate the industry. A recently adopted measure is the "RPI minus X" formula, proposed by Littlechild (1983). This means that the rise of the tariff index of a basket of outputs of a public enterprise should not be larger than the UK retail price index minus X%. Measures that improve the performance of markets and organize an industry are: breaking up the monopoly, and using public firms as policy instruments. This approach has been proposed a.o. by Cremer, Marchand and Thisse (1987). They show that the introduction of a public firm, with the task to maximize total surplus under a budget constraint, results in a socially superior allocation. A similar approach has been adopted by Harris and Wiens (1980), Beato and Mas Colell (1984), and De Fraja and Delbono (1986). The last paper reports that at Nash equilibria, social welfare may be higher when the public firm is instructed to maximize profits rather than total surplus.

A second objective of industrial policy might be to reduce the inefficiency of public firms. Bös (1987) proposes again (partial) privatization of the public enterprise. This influences its objectives, causing a trade off between efficiency and effectivity regarding governmental goals. However, as has been remarked by Yarrow (1986), it is competition that is the best remedy for the problems mentioned.



If the government wants to improve competition despite the presence of external effects in the industry, it is necessary to assign all relevant social cost and benefits to the agents, such that their opportunity sets are influenced. For more competition corresponds with more decentralization, one needs to organize the industry such that specialized markets can perform satisfactorily. One suggestion, made by Starkie (1984), is to separate in public transport the track and signalling systems of railways (the infrastructure) from the operation of train services. Similar suggestions come from Vickers and Yarrow (1985), who argue that it is feasible to restructure British Telecom along such lines to promote competition.

These suggestions fit perfectly with and can be based upon a general equilibrium model designed by Ruys (1984) and Ruys and van der Laan (1987). In that model the symbiosis of the public infrastructure and the private operations is made explicit. An outline is given in the next section.

#### 4. The organization of an industry with external effects

A new concept of goods will be used in the general equilibrium model. It is based on the observation that some private commodities are closely related to public goods, e.g. cars and roads. Such a pair of commodities is called a compound good, if there exists for each agent a feasibility constraint relating a quantity of the private part (called semi private good) with a minimal quantity of the public part (called semi public good) required by that agent. This relation could be represented implicitly in the utility or production function, but will be specified here explicitly and separately. Compound goods are very informative. The demand for the semi private good will be used here as an indicator for the need of the semi public good.

We assume that the semi private goods are produced and supplied by (specialized) private firms on a competitive market. The semi public goods are provided by (specialized) public institutions, but may be produced by the private sector. We assume that such a semi public good is completely financed by a mark-up on the producer's price of the related semi private

good. This means that the compound good can be provided by the industry without subsidy from the government.

Since consumers have different feasibility constraints, their shadow prices are also different. A shadow price is zero, of course, if the constraint is not binding for the consumer. Let  $p_y^i$  be the price of semi private good  $y$  for consumer  $i$ , then

$$p_y^i = p_y + t_{yz} + T_{yz}^i,$$

where  $p_y$  is the producer's price,  $t_{yz}$  the producer's shadow price of his feasibility constraint in producing  $y$ , with respect to the semi public good  $z$ , and  $T_{yz}^i$   $i$ -th consumer's shadow price. Since these shadow prices or tariffs are virtual prices or taxes, we know from disequilibrium theory that an efficient (and feasible) allocation is obtained if all agents are confronted with these prices.

The individual tariffs in our model are not determined by the government, but by the (specialized) private firms supplying directly the semi private goods to the market and maximizing profits. They know the customer's behavior much better than a distant government, and compare for example responsive pricing in elasticity or in transport. Since both the firm and the customer have interest in the provision of the semi public good, and on the other hand competition between firms is mitigating excessive tariffs, it is not unreasonable to expect that diversified tariffs can be set which approximate the individual shadow prices. The revenue of these tariffs is handed over to the (specialized) public institution. This institution has the task to determine the size of the semi public good such that its social cost equals its social benefits. Generally, this boils down to equalize the revenue from the semi-private goods and the production costs of the semi public good. Precise conditions can be found in the papers mentioned above. There it has also been shown that an equilibrium in this economy is Pareto optimal. One may notice that the tax burden is relieved to the amount collected through tariffs.

As an example, we propose some implications of this model for the organization of the transportation industry. This industry is characterized by

multiple modes of transportation (car, taxi, bicycle, bus, train), and various types of enterprises (private or public, professional or household activity). In diagram 2, the organization of such an industry has been depicted. It is assumed in this diagram that the roadsystem and the infrastructure are not considered by the consumers as (pure) public goods, entering their utility functions. If that were the case, there would be a direct demand from travellers (voters) for the provision of those public goods, as expressed by their Lindahl prices.

Some final remarks will be made on the performance of such a mechanism and on problems related with the eventual implementation.

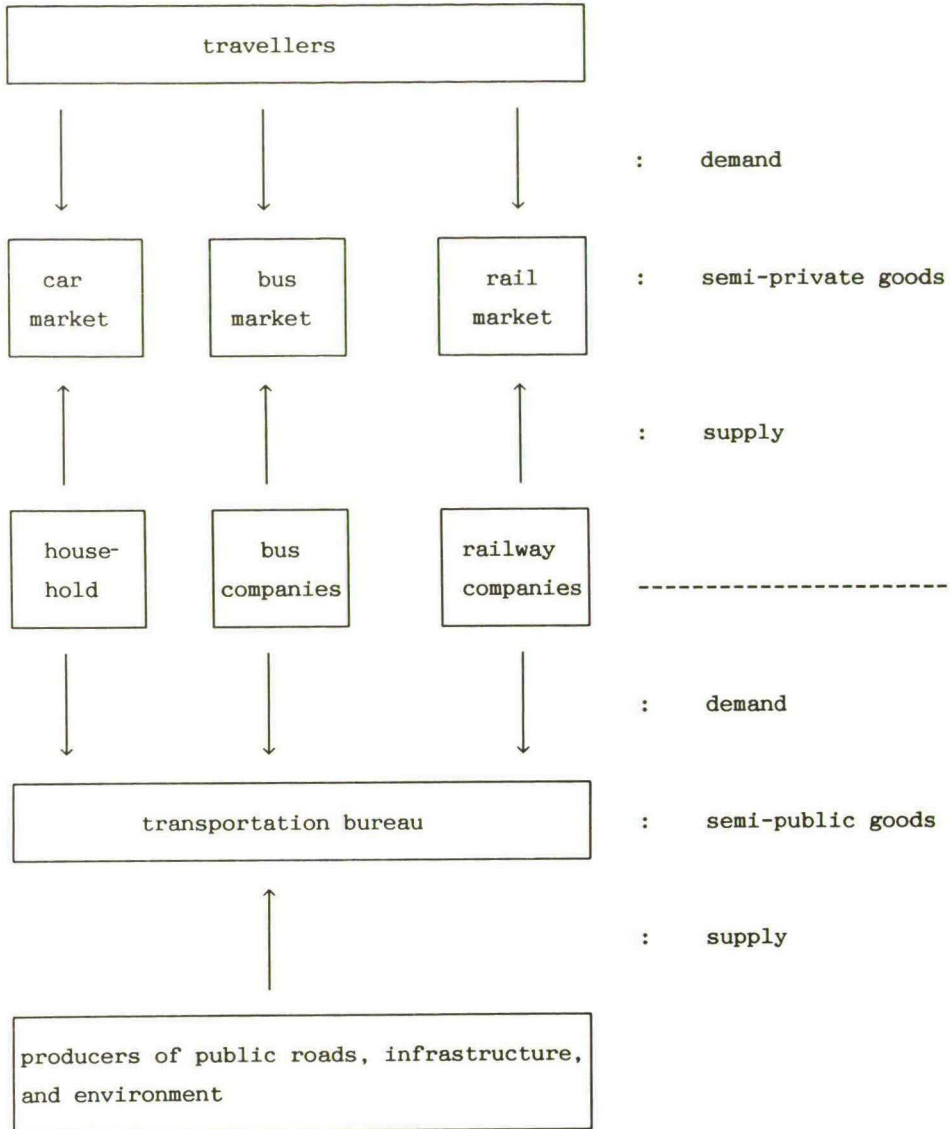
It has been remarked already that in case of external effects which differ in valuation between agents (producers and/or consumers), our mechanism allows for an efficient allocation in the industry and for competition in production. This is made possible by a separation of public and private decisions, together with a correct assignment of social cost and social benefits to the (decentralized) decision units. These decision units have obtained a convexified technology, and have only to decide about (semi) private goods.

For a good performance of our mechanism it is, firstly, required that there is a real need for coordination between, e.g., the various modes of transport within the industry. For, if the social costs and benefits of these various modes are more or less equal for both producers and consumers, there is no need to inform the decision units.

Secondly, the production units should be relatively small or such that the body deciding about semi-private production can relatively easily be replaced. That is required for competition among producers.

Thirdly, no other discrimination of consumers and producers is allowed then on economic grounds. This may contradict, for example, the nationality principle adapted at the moment in European transport policy. This nationality principle says that each country should tax only its own citizens for the national transport infrastructure, such that no European citizen is taxed twice. If the cost of that infrastructure is more or less

Diagram 2: The transportation industry





equal, then this principle protects the traveller against abuse made by local governments of tolls, and contributes considerably to global welfare. But if the costs of infrastructure vary significantly, the nationality principle does not discriminate citizens economically where the optimality conditions require such discrimination. A similar problem arises, of course, within nations, if one compares travelling in cities with travelling in the country. But, given the increasing problems caused by transportation on the environment, and given the serious intention to improve competition on a European scale, a reassessment of established policies seems inevitable.

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